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Solar Power Bank with Wireless Charging

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ABSTRACT

The main aim of this paper is to develop a solar power bank with inverter system to generate 230V AC output. The solar power bank system is for charging mobile phones using wireless power transfer coil. This system can be designed with minimum number of circuit components. We are going to implement here a wireless mobile charging concept, a wireless charging is a type of charging which uses electromagnetic field to transfer energy through electromagnetic induction, energy is transferred through devices through the process of electromagnetic induction. Power banks are one of the most needed thing these days but even power bank needs charging, for that one needs to get the power bank charged in a power plug. This is not always possible when travelling or when outside so here we are going to design a smart solar powered power bank with AC outputs. Using this system we are able to charge cell phone through wireless charging or using AC charger.

KEYWORDS: *Wireless Charging Module, Buck Converter, Solar Panel, Inverter*

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1. INTRODUCTION

Wireless charging is emerging technology now days. Wireless charging is also known as a wireless power transfer; here the power is transferring to the load without interconnecting cords. The solar power bank integrates solar charging with efficient battery support and wireless charging to provide a unique power bank product. The device is able to self-charge anywhere during day time so that the user never runs out of power. Wireless charging is also called as inductive charging. Wireless charging eliminates the cable required for charging. It reduces the wear and tear of hardware ports.. Solar energy is radiant light and heat from the Sun which harnessed using range of technologies such as solar heating, solar thermal energy, solar architecture and photosynthesis. It is an important source of renewable energy and the technologies are broadly characterized as passive solar and active solar depending on way they capture and distribute solar energy. Active solar include use of photo-voltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar include orienting building to Sun, selecting materials with favorable thermal mass, and designing spaces that naturally circulate air.

Solar technology is broadly characterized as passive or active depends on way they capture, convert & distribute sunlight and enable solar energy to be harnessed at different levels. Although the solar energy refers primarily to use of solar radiation for practical ends, all renewable energies, other than geothermal and tidal, derive their energy from the Sun in direct and indirect ways. Solar power is the conversion of sunlight into electricity or directly using photovoltaic, indirectly using concentrated solar power. PV converts the light into electric current using the photoelectric effect.

INVERTER AND THEIR TYPES:

Solar inverters classified into three broad types:

Standalone inverters, it is used in isolated systems where the inverter draws its DC energy from batteries charged by photovoltaic arrays. Many standalone inverters are also incorporate integral battery chargers to replenish the battery from an AC source, when available. These do not interface in any way with the utility grid, and such, are not required to have anti-islanding protection.

Grid tie inverters, which matches phase with a utility-supplied sine wave. Grid tie inverters are designed to shut down automatically upon loss of utility supply, for safety reasons. They do not provide backup power during utility outages.

Battery backup inverters, these are special inverters which are designed to draw energy from a battery, manage the battery charge via on board charger, and export excess energy to the utility grid. These inverters are capable of supplying AC energy to selected loads during the utility outage, and are required to have anti islanding protection.

2. HARDWARE DESCRIPTION:

The hardware part used in this solar power bank are mentioned below.

A. Solar Panel:

Fig.1: Solat Panel

A solar panel is a set of solar photovoltaic module which are electrically connected. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as component of larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each module is rated by its dc output power under standard test conditions and typically ranges from 10 to 320 watts. The efficiency of a module determines the area of module.

A single solar module can produces only limited amount of power, most installation contains multiple modules. A photovoltaic system typically includes panel or an array of solar modules, an inverter, and sometimes a battery or solar track and interconnection wiring.

B. DC DC Buck Converter LM2596 :

Fig 2 : DC-DC Buck Converter

DC-DC Buck Converter Step Down Module LM2596 Power Supply is step down switching regulator, capable of driving a 3 Amp load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and adjustable output version.

The LM2596 series operates at switching frequency of 150kHz, thus allowing smaller sized filter components than what would be required with lower frequency switching regulators. This is a LM2596 DC-DC buck converter step down power module with the high precision potentiometer, capable of driving a load up to 3A with high efficiency, When the output current keeps greater than 2.5A This device is internally compensated to minimize number of external components to simplify the power supply design.

C. Wireless Charging Module :

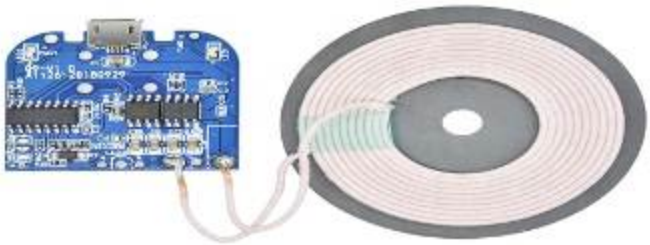

Fig 3: Wireless Charging Module

This is a portable digital wireless charging module works on 5V DC supply voltage with Micro USB port for input Supply. We can provide supply to the module from our smart phone charger or from PC USB port.

This Circuit comes with LED Indicator Light to show the status, like the GREEN LED glow showing circuit is powered up. While it has BLUE LED for showing status of detection of the phone and charging Status.

D. Wireless Power Tx/Rx Module :

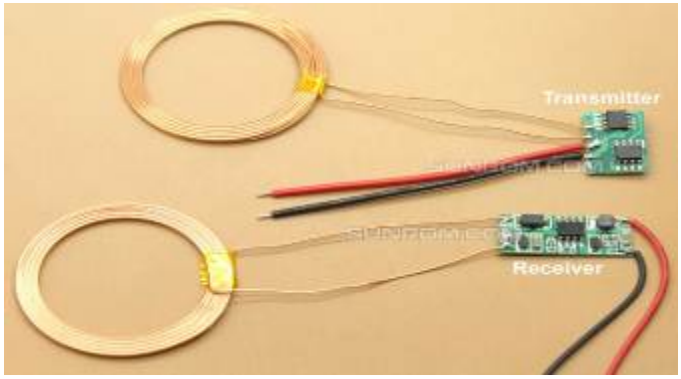

Fig 4: Wireless Power Tx/Rx Module

The Wireless Power Transfer and Charging Module can be used in electronic equipments in common use for close wireless charging or power supply. Consist of a Transmitter & Receiver and coil, it could serve as a replacement for the Wireless Power Supply with stable 5V output voltage and maximum 600mA output current. Its small size and insulation coil is more suitable for using in wireless project.

This module uses an electromagnetic field to transfer electric energy between a transmitter circuit and a receiver circuit. An induction coil creates an alternating electromagnetic field from within the transmitter circuit powered with 12V. The second induction coil takes power from the electromagnetic field and converts it back into electrical current to the receiver circuit that outputs 5V - 600mA.

E. Battery Level Indicator :

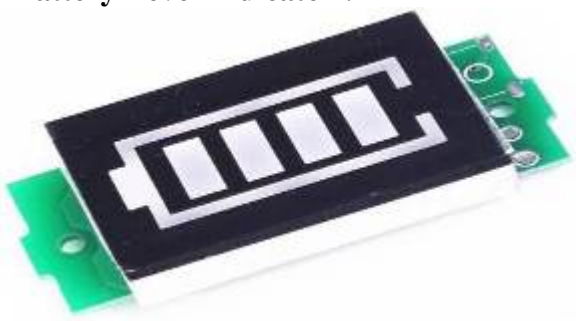

Fig 5: Battery Level Indicator

This is a battery type capacity indicator module display shows the display is more intuitive and more beautiful. A wider range of applications, nickel-metal hydride batteries, 18650 and polymer lithium battery packs, lead-acid storage, electric vehicle batteries, electric equipment can be used.

This display has a reverse connection function, even if the positive and negative connection will not burn. To use the display just connect the positive and negative terminals of the display board to the positive and negative terminals of the battery under test. The digital tube will display the real-time battery power.

3. BLOCK DIGRAMOF BLACK BOX:

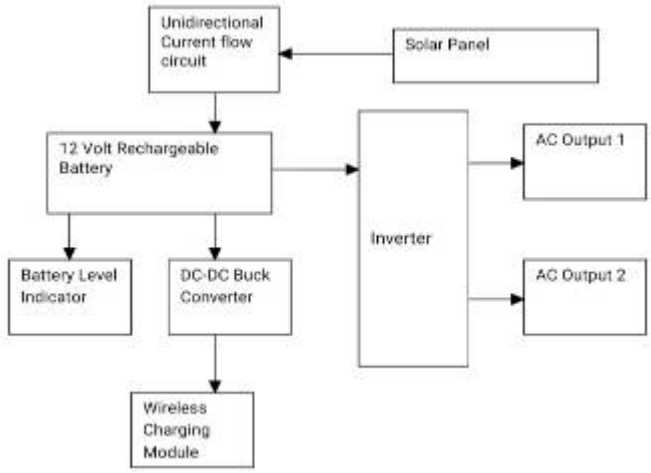

Fig 6: Block Diagram

Working:

Solar panels convert solar energy into electricity. They use the concept of photoelectric effect, emission of electrons when light falls on solar panel. Solar panels are made up of silicon cells, silicon has an atomic number 14. When light falls on silicon cell, the outer most electrons of silicon i.e. two electrons are set into motion. This initiates the flow of electricity. Silicon has two different cell structures: mono crystalline and polycrystalline Mono crystalline solar panels are manufactured from one large silicon block and are made in silicon wafer formats. Polycrystalline solar cells are also silicon cells, which are produced by melting multiple silicon crystals together. Mono-crystalline silicon cells are more efficient but expensive when compared to polycrystalline cells. Solar energy converted into electrical form and saved to the lead acid battery. This battery power supplied to the wireless charging module and inverter circuit.

Wireless Battery Charger Circuit Principle:

This circuit mainly works on the principle of mutual inductance. Power is transferred from transmitter to the receiver wirelessly based on the principle of "inductive coupling".

Inductance is the property of the conductor, in which the current flowing in a conductor induces a voltage or electromotive force in it or in another nearby conductor. There are two types inductance. 1) Self inductance, 2) Mutual Inductance.

"Mutual inductance" is the phenomena in which, when a current carrying conductor is placed near another conductor voltage is induced in that conductor. This is because, as the current is flowing in the conductor, a magnetic flux is induced in it. This induced magnetic flux links with another conductor and this flux induces voltage in the second conductor. Thus two conductors are said to be inductively coupled and power transfer will take place.

4. RESULT:

The result shows prototype of solar powered power bank and inverter with dual AC output. This project works perfectly and charge the mobile phone properly using wireless charging and using inverter.

Fig 7: Final Project Model

5. CONCLUSION

Therefore in this project we have successfully developed a solar power bank with inverter successfully. To charge the battery the power from solar panel is fed to the battery. Then the battery power given to buck converter and wireless module and inverter circuit. inverter converts dc 12 v to ac 230v AC. A 5watt bulb is lit at the output as a load.

Wireless charging technology gradually eliminates the use of wired cords. It is more convenient and easy method. This technique eliminates the wear and tear of the hardware ports. This technology mainly provides portability to the user. Wireless charging seems a good idea and has been introduced to many mobiles iPhone 7(Apple), galaxy S5 (Samsung), Lumia 930(Microsoft), and xperia z3 (sony).These mobiles are built on the concept of inductive charging.

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